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Summary of Perchlorate in Fertilizers and Plants
EPA, Office of Research and Development

Perchlorate (ClO4 -) is a chemical that has been found to contaminate ground and surface waters, where it is mobile and can persist for decades. A major source of contamination has been the disposal of perchlorate following its manufacture and use as a propellant for rockets and fireworks.

Since the 1950's when potassium perchlorate was given to treat patients with hyperthyroidism, perchlorate has been known to disturb the balance of thyroid hormones by causing a decrease in their production. However, a 1997 expert peer review of existing toxicology data deemed these data inadequate for quantitative health risk assessment of potential adverse effects. According to the panel, the potential health effects to be characterized included thyroid cancer as well as neurodevelopmental, reproductive, and immunotoxicological effects.

EPA is currently assessing the risks posed by perchlorate, and perchlorate risk assessment is one of the major activities of the Interagency Perchlorate Steering Committee. This committee is made up of representatives from EPA, the Department of Defense, and a number of other federal, state, and tribal agencies. EPA's perchlorate effort involves a number of Agency offices, including the Office of Research and Development (ORD), the Office of Solid Waste and Emergency Response, the Office of Water, and EPA Region 9.

Perchlorate research is being conducted by EPA and others. As part of this research, scientists at ORD's National Exposure Research Laboratory (NERL) in Athens, Georgia investigated the content of perchlorate in some commercial fertilizers. Of nine brands tested, each contained detectable levels of perchlorate. A short Research Communication highlighting these findings was published in the October 1, 1999 edition of the journal *Environmental Science & Technology (ES&T).* [The Fertilizer Institute raised technical concerns about ORD's reported findings, and these concerns were addressed in an Additions and Corrections published in the January 1, 2000, issue of *ES&T.*]

Including the work reported in *ES&T*, ORD scientists (and others) have, to date, found perchlorate at high levels (about 500 - 8000 mg/kg) in over 90% of more than 25 fertilizers (primarily lawn-and-garden products) not identified as containing components derived from mined Chilean saltpeter, which is known to contain perchlorate naturally. These products were all acquired over the period of November 1998 to January 1999.

Subsequently, ORD scientists analyzed more than 20 fertilizer products, acquired between August 1999 and March 2000. Some of these were the same products (although not the same lots) as those previously sampled. Perchlorate

was found in only 2 of these products - both hydroponic fertilizers - and at a lower level than measured before. Several more hydroponic fertilizers have been purchased to assess how widespread this situation may be.

- As part of this research effort, a Raman spectroscopic method has been developed for both qualitative and quantitative analysis of perchlorate in fertilizers. This method has a detection level of approximately 20 ppm in aqueous extracts and will be useful in future perchlorate analyses.

- ORD is also currently participating in an Agency/industry joint investigation of perchlorate in fertilizers, in light of the significant variations in perchlorate levels reported to date (potentially due to differences in raw materials and sampling methods).
((More should be included about this effort, e.g., what joint projects will deliver what results when.))

- EPA is also investigating methods to mitigate perchlorate contamination. One method under study is phytoremediation – the use of plants to degrade or take up contaminants. As part of this research, ORD scientists have investigated different kinds of plants and found that their activities vary. Preliminary studies in the laboratory and in the greenhouse have found that some plants break down perchlorate (directly or by spurring degradation by soil microbes), while others take up perchlorate and accumulate it for a period of time in their leaves, stems and roots. Additional experimental work is needed to confirm these preliminary findings.

- Perchlorate uptake by tobacco plants in the 1999 growing season was investigated by analyzing samples of mature green tobacco leaf, flue-cured leaf, soil, and the applied fertilizers, including Bulldog Soda, a Chilean nitrate fertilizer that contains perchlorate as a natural impurity. Results show that perchlorate is accumulated by tobacco plants into the lamina and midrib of the leaves from soils amended with Bulldog Soda.

- Perchlorate can persist over an extended period of time and under a variety of industrial processes as shown by its presence in off-the-shelf tobacco products. ORD scientists analyzed five brands of chewing tobaccos, two cigarette brands and one brand of cigar purchased in November-December 1999. Using ion chromotography, perchlorate was detected in all but one of the other tobacco products at levels ranging from 0.4 mg/kg to 21.5 mg/kg. Both the lowest and highest levels were in chewing tobaccos.

- At this time ORD believes that the fertilizer and plant-uptake studies are too preliminary to evaluate what risks, if any, perchlorate in fertilizers or plants pose to the public. ORD's findings may have implications for an additional route of exposure (food) and, if so, will be incorporated into the perchlorate risk assessment as it is revised. EPA currently expects to issue a draft of the risk

assessment for a second external peer review in Fall 2000.

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